1. An ICP source for producing a high-density inductively coupled plasma in a vacuum chamber for processing a semiconductor wafer therewith, the source comprising:

a dielectric chamber wall formed of at least one section of dielectric material and having a vacuum side and an atmospheric side;

a peripheral ionization source including an RF antenna on the atmospheric side of the dielectric chamber wall, and a protective shield on the vacuum side of the dielectric chamber wall, the shield having slots therethrough and being configured to inhibit the deposition of material from the chamber onto the vacuum side of the dielectric chamber wall and to facilitate inductive coupling of RF energy from the antenna through the shield and into the chamber; and

the peripheral ionization source having a segmented configuration of alternating high and low-radiation sections arranged in a ring and positioned to couple power through the dielectric chamber wall into the chamber in an annular alternating high and low power distribution.

2. The ICP source of claim **1** wherein:

the shield has a segmented configuration of alternating high and low-transparency sections arranged in a ring and positioned to facilitate the coupling of power through the dielectric chamber wall into the chamber in the annular alternating high and low power distribution, the high-radiation sections of the peripheral ionization source including the high-transparency sections of the shield and the low radiation sections of the peripheral ionization source including the low-transparency sections of the shield.

3. The ICP source of claim **2** wherein:

the high-transparency sections of the shield have a plurality of slots therethrough and low-transparency sections of the shield are electrically conductive and generally solid relative to the high-transparency sections.

4. The ICP source of claim **3** wherein:

the shield is flat and circular, and the high-transparency sections thereof have a plurality of radially extending slots therethrough.

5. The ICP source of claim **4** wherein:

the antenna has a segmented configuration and includes:

a plurality of spatially concentrated conductor segments thereof parallel to the dielectric chamber wall and perpendicular to the slots and aligned with the high-transparency sections of the shield, and

a plurality of spatially distributed conductor segments aligned with the low-transparency sections of the shield;

the high-radiation sections of the peripheral ionization source including the spatially concentrated conductor segments and the low radiation sections of the peripheral ionization source including the low-transparency sections of the shield.

6. An iPVD apparatus having the source of claim **4**.

7. The ICP source of claim **3** wherein:

the shield is generally cylindrical, and the high-transparency sections thereof have a plurality of axially extending slots therethrough.

8. The ICP source of claim **7** wherein:

the antenna has a segmented configuration and includes a plurality of spatially concentrated conductor segments thereof parallel to the dielectric chamber wall and perpendicular to the slots and aligned with the high-transparency sections of the shield, and a plurality of spatially distributed conductor segments aligned with the low-transparency sections of the shield.

9. The ICP source of claim **8** wherein:

at least some of the spatially distributed conductor segments are positioned to capacitively couple energy around the shield and into the chamber for plasma ignition.

10. A plasma etch apparatus having the ICP source of claim **8**.

11. The ICP source of claim **1** wherein:

the antenna has a segmented configuration formed of at least one conductor having alternating high and low-efficiency sections arranged in a ring and positioned to couple power through the dielectric chamber wall and into the chamber in the annular alternating high and low power distribution, the high-radiation sections of the peripheral ionization source including the high-efficiency sections of the antenna and the low-radiation sections of the peripheral ionization source including the low-efficiency sections of the antenna.

12. The ICP source of claim **11** wherein:

the high-efficiency sections of the antenna provide concentrated antenna current paths close to the dielectric chamber wall and the low-efficiency sections provide distributed antenna current paths.

13. The ICP source of claim **11** wherein:

the high-efficiency sections of the antenna are formed of small cross-section conductors close to the dielectric chamber wall and the low-efficiency sections of the antenna are formed of relatively large cross-section conductors.

14. The ICP source of claim **11** wherein:

the high-efficiency sections of the antenna are formed of a plurality of closely spaced conductor segments and the low-efficiency sections of the antenna are formed of a plurality of conductor segments that are substantially more widely spaced than the closely spaced conductor segments.

15. The ICP source of claim **11** wherein:

the shield has a segmented configuration of alternating high and low-transparency sections arranged in a ring and positioned to facilitate the coupling of power through the dielectric chamber wall in the annular alternating high and low power distribution into the chamber, the high-radiation sections of the peripheral ionization source having included therein the high-transparency sections of the shield and the low-radiation sections of the peripheral ionization source including the low-transparency sections of the shield, the high-efficiency sections of the antenna being aligned with the high-transparency sections of the shield and the low-efficiency sections of the antenna being aligned with the low-transparency sections of the shield.

16. The ICP source of claim **15** wherein:

the dielectric chamber wall includes a plurality of discrete pieces of dielectric material, one for each of the high-radiation sections of the peripheral ionization source, one between each high-efficiency section of the antenna and the high-transparency section of the shield with which it is aligned.

17. A semiconductor wafer processing apparatus having the source of claim **1**.

18. An antenna for inductively coupling energy into a high-density plasma in a vacuum chamber for processing a semiconductor wafer therewith, the antenna comprising:

a segmented configuration formed of at least one conductor of alternating high and low-efficiency sections arranged in a ring, the high-efficiency sections including concentrated current-carrying segments producing relatively high magnetic fields adjacent thereto and the low-efficiency sections including distributed current-carrying segments producing relatively low magnetic fields adjacent thereto.

19. The antenna of claim **18** wherein:

the high-efficiency sections of the antenna are formed of small cross-section conductors and the low-efficiency sections of the antenna are formed of relatively large cross-section conductors.

20. The antenna of claim **18** wherein:

the high-efficiency sections of the antenna are formed of a plurality of closely spaced conductor segments and the low-efficiency sections of the antenna are formed of a plurality of conductor segments that are substantially more widely spaced than the closely spaced conductor segments.

21. A method of producing a high-density inductively coupled plasma in a vacuum chamber for processing a semiconductor wafer therewith, comprising:

providing an RF antenna on the atmospheric side of a dielectric chamber wall having a segmented configuration of alternating high and low-efficiency sections;

providing a protective shield on the vacuum side of the dielectric chamber wall having slotted high-transparency sections aligned with the high-efficiency sections of the antenna to inhibit the deposition of material from the chamber onto the vacuum side of the dielectric chamber wall and to facilitate inductive coupling of RF energy from the antenna into the chamber; and

couple power from the high-efficiency sections of the antenna, through the dielectric chamber wall, and into the chamber in an annular alternating high and low power distribution plasma ring.